TABLE 6-2 Three-Dimensional Reactions at Supports and Connections

(1) BALL AND SOCKET

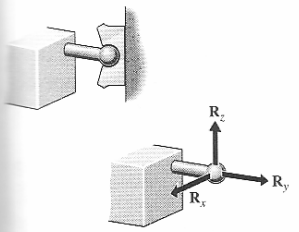


Figure 6-14

A ball and socket joint (Fig. 6-14) can transmit a force **R** but no moment. The force **R** is usually represented on a free-body diagram by its three rectangular components $\mathbf{R}_x$, $\mathbf{R}_y$, and $\mathbf{R}_z$.

(2) HINGE

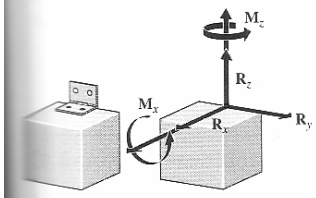


Figure 6-15

A hinge (Fig. 6-15) is normally designed to transmit a force **R** in a direction perpendicular to the axis of the hinge pin. The design may also permit a force component to be transmitted along the axis of the pin. Individual hinges also have the ability to transmit small moments about axes perpendicular to the axis of the pin. However, properly aligned pairs of hinges transmit only forces under normal conditions of use. Thus, the action of a hinge is represented on a free-body diagram by the force components $\mathbf{R}_x$, $\mathbf{R}_y$, and $\mathbf{R}_z$ and the moments $\mathbf{M}_x$, and $\mathbf{M}_z$ when the axis of the pin is in the y-direction.

(3) BALL BEARING

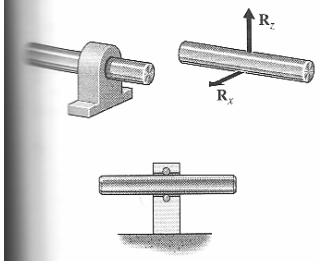
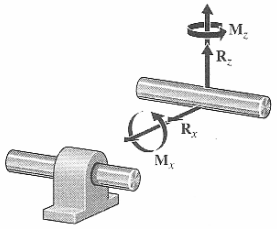


Figure 6-16

Ideal (smooth) ball bearings (Fig. 6-16) are designed to transmit a force **R** in a direction perpendicular to the axis of the bearing. The action of the bearing is represented on a free-body diagram by the force components $\mathbf{R}_x$ and $\mathbf{R}_z$ when the axis of the bearing is in the y-direction.

Table 6-2 (continues next page)

(4) JOURNAL BEARING



Journal bearings (Fig. 6-17) are designed to transmit a force **R** in a direction perpendicular to the axis of the bearing. Individual journal bearings also have the ability to transmit small moments about axes perpendicular to the axis of the shaft. However, properly aligned pairs of bearings transmit only forces perpendicular to the axis of the shaft under normal conditions of use. Therefore, the action of a journal bearing is represented on a free-body diagram by the force components $\mathbf{R}_x$ and $\mathbf{R}_z$ and the couple moments $\mathbf{M}_x$ and $\mathbf{M}_z$ when the axis of the bearing is in the y-direction.

(5) THRUST BEARING

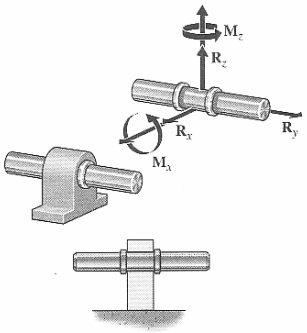


Figure 6-18

A thrust bearing (Fig. 6-18), as the name implies, is designed to transmit force components both perpendicular and parallel (thrust) to the axis of the bearing. Individual thrust bearings also have the ability to transmit small moments about axes perpendicular to the axis of the shaft. However, properly aligned pairs of bearings transmit only forces under normal conditions of use. Therefore, the action of a thrust bearing is represented on a free-body diagram by the force components $\mathbf{R}_x$, $\mathbf{R}_y$, and $\mathbf{R}_z$ and the couple moments $\mathbf{M}_x$ and $\mathbf{M}_z$ when the axis of the bearing is in the y-direction.

(6) SMOOTH PIN AND BRACKET

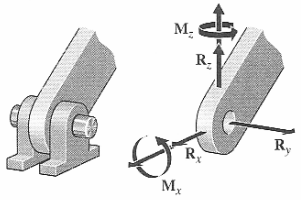


Figure 6-19

A pin and bracket (Fig. 6-19) is designed to transmit a force **R** in a direction perpendicular to the axis of the pin but may also transmit a force component along the axis of the pin. The unit also has the ability to transmit small moments about axes perpendicular to the axis of the pin. Therefore, the action of a smooth pin and bracket is represented on a free-body diagram by the force components $\mathbf{R}_x$, $\mathbf{R}_y$, and $\mathbf{R}_z$ and the couple moments $\mathbf{M}_x$ and $\mathbf{M}_z$ when the axis of the pin is in the y-direction.

(7) FIXED SUPPORT

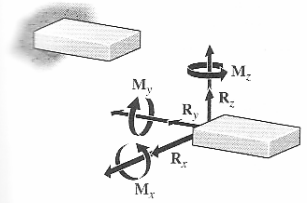


Figure 6-20

A fixed support (Fig. 6-20) can resist both a force **R** and a couple **C**. The magnitudes and directions of the force and couple are not known. Thus, the action of a fixed support is represented on a free-body diagram by the force components $\mathbf{R}_x$, $\mathbf{R}_y$, and $\mathbf{R}_z$ and the moment components $\mathbf{M}_x$, $\mathbf{M}_y$, and $\mathbf{M}_z$.

From Statics and Mechanics of Materials, Riley, Sturges and Morris